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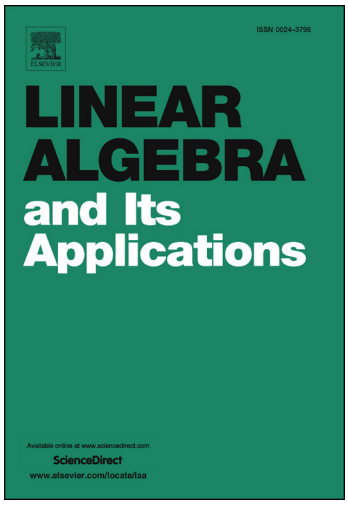

A directed graph structure of alternating sign matrices

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A DIRECTED GRAPH STRUCTURE OF ALTERNATING SIGN MATRICES

MASATO KOBAYASHI

Abstract. We introduce a new directed graph structure into the set of alternating sign matrices. This includes Bruhat graph (Bruhat order) of the symmetric groups as a subgraph (subposet).

Drake-Gerrish-Skandera (2004, 2006) gave characterizations of Bruhat order in terms of total nonnegativity (TNN) and subtraction-free Laurent (SFL) expressions for permutation monomials. With our directed graph, we extend their idea in two ways: first, from permutations to alternating sign matrices; second, q-analogs (which we name qTNN and qSFL properties). As a by-product, we obtain a new kind of permutation statistic, the signed bigrassmannian statistics, using Dodgson's condensation on determinants.

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Key words and phrases. Alternating sign matrices, Bigrassmannian permutations, Bruhat order, determinant, Essential sets, Permutation Statistics, Subtraction-Free Laurent expressions, Total nonnegativity.

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